

of the display, some amount of material flexing occurs as well. In opening a folding fan, the rotation of the unsupported display sections will generally cause the support members 502 to flex out of the plane of the display to some degree while the fan is opened. However, since the support members 502 produce some mechanical resistance to this flexing, the display sections 510 are forced to flex as well. Both flexing forces are relieved as the rotation of the unsupported display section 510 is completed. Analogous effects occur in reverse as the folding fan display is closed.

[0051] FIG. 6 shows a second possible fan configuration 600, referred to herein as a “brisé fan” configuration in which a plurality of non-deformable panel sections 602 are connected to a common pivot point 504. The panel sections 602 may each support a non-deformed section of a visual display. As with the folding fan configuration 500, when the brisé fan configuration 600 is collapsed, the panel sections 602 substantially overlap in a common lateral position. However, unlike the folding fan configuration 500, the panel sections 602 do not individually collapse.

[0052] The expanded brisé fan configuration 600 also has similar attributes to the expanded folding fan configuration 500. For example, in both, a fan-shaped geometry of larger area is formed when each section is expanded, then reduced when the configurations are collapsed. Also, when in an expanded configuration, non-adjacent ends of adjoining panel sections 602 are not parallel to each other or to a common axis 512 formed by their adjacent ends.

[0053] FIG. 7 shows additional expanded fan display configurations 700 that may be used for a collapsible display. In general, fan-shaped collapsible displays are most usefully provided in any shapes that are instances of the class of star polygons (in which there exists a specific point within the polygon that can be connected to any other point within the polygon by an imaginary line segment that lies wholly within the polygon), which includes as a special case the class of fan polygons (in which a fully-connected edge-point can be connected to any other point within the polygon by an imaginary line segment that lies wholly within the polygon). Many variations of such star polygons can be used, such as any one or more of the following classes of geometries: convex polygons (in which any point within the polygon that can be connected to any other point within the polygon by an imaginary line segment that lies entirely within the polygon), concave polygons (in which there exist a pair of points within the polygon that can not be connected by an imaginary line segment that lies wholly within the polygon), and variants bounded by curved edges instead of straight edges, such as circles, ellipses, ovals and semi-circles. Non-fan-polygon shapes may also be used, but such shapes typically include unsupported corner points that would form hanging flaps, which are clearly undesirable for portable display applications. Alternatively, the hanging flaps would require an assortment of additional supports that would adversely impact design complexity.

[0054] In various embodiments, the display configuration 700 has an actual display area 702 that is less than or equal to the entire area of the expanded fan display 700. The actual display area 702 may be those portions of a display membrane 400 having control layer components, display layer components and/or pixels for presenting visual information. In embodiments where the actual display area 702 is sub-

stantially the same as that of the entire expanded display 700, both the actual display area 702 and the expanded display 700 may be of the same shape. Alternatively, the actual display area 702 may be of a smaller area and may further be a second shape (e.g., a rectangle, a convex polygon, a concave polygon) inscribed within the larger expanded display configuration 700, or a similar shape of smaller dimensions.

[0055] In various embodiments, the display 700 may be integrated with an electronic device 704. The electronic device may be any portable or hand-held device, such as laptop and notebook personal computers, televisions, personal digital assistants, cellular telephones, satellite telephones, electronic document readers and any of a variety of user input devices, such as keyboards. The device 704 may include a display controller for providing display instructions to the display 700. Alternatively, the display 700 may be a standalone device that receives display instructions from an on-board display controller, a display wand, a light pen, a user input device, an on-board wireless receiver or a hard-wired port for receiving display instructions from a remote device.

[0056] The shape of the electronic device 704 need not always be rectangular as shown, although they are frequently produced in such a configuration. For sake of brevity, only the case of a substantially rectangular electronic device 704 will be specifically addressed herein. It should be readily appreciated that the electronic device 704 may be provided in any of a variety of shapes.

[0057] Whereas FIG. 7 shows the pivot point 504 of expanded fan configurations attached substantially at a mid-point of an adjacent edge of an integrated portable electronic device 704, it is readily contemplated that other attachment points along the device 704 are possible. For example, as shown in FIG. 8, an expanded display 700 may extend from a corner of an electronic device 704. Attachment at the corner of a device allows a greater diameter, and thus, a greater display area for the expanded display. This is especially true where a corner-mounted display is retractable or partially retractable into device for storage, and the collapsed display may be retracted along the device's diagonal rather than its shorter length or width. Attachment at the corner also allows the fan display to be expanded to areas greater than 180 degrees of a circle. In various such configurations, the display 700 may be expanded to form any wedge shape up to 270 degrees of a complete circle. Such corner-mounted configurations thus readily allow for an expanded display area that is greater than that of the attached device. It should be readily appreciated that the display 700 may likewise be less than 180 degrees of a circle when partially or fully expanded.

[0058] As shown in FIGS. 8 and 9, the expanded display 700, whether mounted on a side or a corner of the device 704, may be longer and/or wider than that of the integrated device 704. In certain embodiments, shown in FIG. 9, the display area may be a larger rectangular area, and may have a 2:1 length-to-width aspect, or a 4:3 length-to-width aspect as are common in current displays. Where the display area 702 is not in a conventional rectangular configuration, conversion of standard display instructions (e.g., by distortion, such as the hyperbolic distortion described in U.S. Pat. No. 5,590,250) may be performed, either by a display